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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Makoto IKEDA Serial No.: unknown
Filed: concurrent herewith Docket No.: 12052.41US01
Title: LINE ILLUMINATING DEVICE

CERTIFICATE UNDER 37 CFR 1.10

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By: 

Name: Brian Maharaj

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In connection with the above-identified application filed herewith, please enter the following preliminary amendment:

IN THE SPECIFICATION:

Please replace the paragraph beginning at page 8, line 30, with the following rewritten paragraph:

- - Fig. 3 (a), 3 (b), and 3 (c) are graphs showing distribution of light intensity in a main-scanning direction in a document-reading surface; - -

Please replace the paragraph beginning at page 8, line 32, with the following rewritten paragraph:

- - Fig. 4 (a) and 4 (b) are graphs showing spatial distribution of light intensity in a sub-scanning direction; - -

Please replace the paragraph beginning at page 9, line 4, with the following rewritten paragraph:

- - Fig. 6 (a), 6 (b) and 6 (c) are cross-sectional views of a line illuminating device according to a third embodiment of the present invention; - -

Please replace the paragraph beginning at page 9, line 6, with the following rewritten paragraph:

- - Fig. 7 (a) and 7 (b) are perspective views of the line illuminating device according to the third embodiment of the present invention; - -

Please replace the paragraph beginning at page 9, line 8, with the following rewritten paragraph:

- - Fig. 8 (a), 8 (b) and 8 (c) are cross-sectional views of a line illuminating device according to a fourth embodiment of the present invention; - -

Please replace the paragraph beginning at page 9, line 10, with the following rewritten paragraph:

- - Fig. 9 (a), 9 (b) and 9 (c) are cross-sectional views of a line illuminating device according to a fifth embodiment of the present invention; - -

Please replace the paragraph beginning at page 9, line 16, with the following rewritten paragraph:

- - Fig. 12 (a), 12 (b) and 12 (c) are views showing an arrangement of light-scattering patterns and distribution of light intensity in the line illuminating device according to the sixth embodiment of the present invention; - -

Please replace the paragraph beginning at page 9, line 19, with the following rewritten paragraph:

- - Fig. 13 (a), 13 (b) and 13 (c) are perspective views of a line illuminating device according to a seventh embodiment of the present invention; - -

Please replace the paragraph beginning at page 9, line 32, with the following rewritten paragraph:

- - Fig. 19 (a) and 19 (b) are views showing an output signal when a document with a black rectangular area is read in the line illuminating device as shown in Fig. 16; - -

IN THE CLAIMS

Please amend claims 3, 4 and 8 as follows:

3. (amended) The line illuminating device according to claim 1, wherein each light guide is housed in a casing in such a manner that at least the emission plane is exposed.
4. (amended) The line illuminating device according to claim 1, wherein the light guide is formed with light-scattering patterns for scattering illuminating light at a predetermined plane except for an incident plane and the emission plane of the light guide.
8. (amended) The line illuminating device according to claim 5, wherein, under conditions where the pair of light guides are arranged in such a manner that the light emitted from each emission plane irradiates the same area of the document-reading plane, one light guide is provided with a light-emitting source at one end of the longitudinal direction, while the other light guide is provided with a light-emitting source at the other end of the longitudinal direction.

REMARKS

The above preliminary amendment is made to remove multiple dependencies from claims 3, 4 and 8. The specification has been amended to more accurately describe the figures.

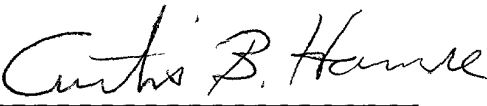
Applicants respectfully request that the preliminary amendment described herein be entered into the record prior to calculation of the filing fee and prior to examination and consideration of the above-identified application.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Curtis B. Hamre (Reg. No. 29,165), at (612) 336-4722.

Respectfully submitted,

MERCHANT & GOULD P.C.
P.O. Box 2903
Minneapolis, Minnesota 55402-0903
(612) 332-5300

Dated: March 16, 2001

By 
Curtis B. Hamre
Reg. No. 26,165

CBH/klj/kmg

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line illuminating units, each housing a light guide in a casing, in which the light guide is adapted to guide light from a light source incident from an end in the longitudinal direction and to scatter the light in light-scattering patterns which are formed along the longitudinal direction to emit this light from the emission plane, characterized in that
5 each line illuminating unit is arranged in such a manner that the light emitted from each emission plane of each light guide illuminates the same area of a document-reading surface, and the light guide casing has at least a part of its outside surface treated to control scattering and reflection of the light.

The line illuminating device according to the present invention is characterized
10 in that the light guide casing has at least a part of its outside surface covered by a member for controlling scattering and reflection the light.

Since at least a part of the outside surface of the light guide casing is provided with a coating film for controlling scattering and reflection of the light or is covered by the member for controlling scattering and reflection of the light, it is possible to prevent
15 the light scattered and reflected from the document surface from being scattered and reflected again at the light guide casing. With this, irradiation by the light scattered and reflected at the light guide casing on the document surface is eliminated. Accordingly, the original intensity distribution of the illuminating light is not disturbed by the scattered and reflected light from the light guide casing and as a result, an image can be
20 clearly read.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following description when taken in conjunction
25 with the accompanying drawings.

Fig. 1 is a perspective view of a line illuminating device according to a first embodiment of the present invention;

Fig. 2 is a cross-sectional view of a document-reading device incorporating the line illuminating device as shown in Fig.1;

30 [Fig. 3 is a graph] showing distribution of light intensity in a main-scanning direction in a document-reading surface;
-- Fig. 3(a), 3(b) and 3(c) are graphs --

[Fig. 4 is a graph] showing spatial distribution of light intensity in a sub-scanning direction;
-- Fig. 4(a) and 4(b) are graphs --

Fig. 5 is a cross-sectional view of a document-reading device incorporating a line illuminating device (a line illuminating device provided with two illuminating units with a casing) according to a second embodiment of the present invention;

5 [Fig. 6 is a cross-sectional view] of a line illuminating device according to a third embodiment of the present invention;
 -- Fig. 6(a), 6(b) and 6(c) are cross-sectional views --

 [Fig. 7 is a perspective view] of the line illuminating device according to the third embodiment of the present invention;
 -- Fig. 7(a) and 7(b) are perspective views --

 [Fig. 8 is a cross-sectional view] of a line illuminating device according to a fourth embodiment of the present invention;
 -- Fig. 8(a), 8(b) and 8(c) are cross-sectional views --

10 [Fig. 9 is a cross-sectional view] of a line illuminating device according to a fifth embodiment of the present invention;
 -- Fig. 9(a), 9(b) and 9(c) are cross-sectional views --

Fig. 10 is a cross-sectional view of a contact-type image sensor to which a line illuminating device according to a sixth embodiment of the present invention is applied;

15 Fig. 11 is a perspective view of the line illuminating device according to the sixth embodiment of the present invention;

 [Fig. 12 is a view] showing an arrangement of light-scattering patterns and distribution of light intensity in the line illuminating device according to the sixth embodiment of the present invention;
 -- Fig. 12(a), 12(b) and 12(c) are views --

20 [Fig. 13 is a perspective view] of a line illuminating device according to a seventh embodiment of the present invention;
 -- Fig. 13(a), 13(b) and 13(c) are perspective views --

Fig. 14 is a view showing another arrangement example of the light-scattering patterns;

Fig. 15 is a view showing yet another arrangement example of the light-scattering patterns;

25 Fig. 16 is a view showing a problem of a line illuminating device in which two line illuminating units are opposedly arranged, wherein only one line illuminating unit is lighted;

Fig. 17 is a graph of light intensity characteristics in a condition without a document in the line illuminating device as shown in Fig. 16;

30 Fig. 18 is a graph of light intensity characteristics in a condition with a white document in the line illuminating device as shown in fig. 16;

 [Fig. 19 is a view] showing an output signal when a document with a black rectangular area is read in the line illuminating device as shown in Fig. 16;
 -- Fig. 19(a) and 19(b) are views --

Marked up Copy of Claims

What is claimed is:

1. A line illuminating device having two light guides for guiding light from a light source incident from an end surface in the longitudinal direction and for emitting the light from an emission plane formed along the longitudinal direction, characterized in that these light guides are arranged in such a manner that the light emitted from the emission plane of each light guide irradiates the same area of a document-reading plane, and one light guide is provided, at one end of its longitudinal direction, with a first light-emitting source, while the other light guide is provided, at the other end of its longitudinal direction, with a second light-emitting source.
2. The line illuminating device according to claim 1, wherein each light guide is symmetrically arranged relative to a plane where the emission plane is at right angles to the document-reading plane.
3. The line illuminating device according ^{--to claim 1, --} ~~to claim 1 or claim 2,~~ wherein each light guide is housed in a casing in such a manner that at least the emission plane is exposed.
4. The line illuminating device according ^{--to claim 1, --} ~~to any of claims 1 through 3,~~ wherein the light guide is formed with light-scattering patterns for scattering illuminating light at a predetermined plane except for an incident plane and the emission plane of the light guide.
5. A line illuminating device having a pair of light guides arranged to guide light from a light source incident from an end surface in the longitudinal direction and to scatter the incident light at light scattering patterns formed intermittently over the longitudinal direction so as to irradiate the same area of a document-reading plane, characterized in that these light guides are alternately arranged so that the light-scattering patterns formed on one light guide compensate for the shortage of light-scattering patterns formed on the other light guide.
6. The line illuminating device according to claim 5, wherein each light guide is symmetrically arranged relative to a plane where the emission plane is at right angles to the document-reading plane.
7. The line illuminating device according to claim 5, wherein each light guide is placed one upon another, and the emission plane is arranged on one side relative to a plane where the emission plane is at right angles to the document-reading surface.
8. The line illuminating device according ^{--to claim 5, --} ~~to any of claims 5 through 7,~~ wherein,

under conditions where the pair of light guides are arranged in such a manner that the light emitted from each emission plane irradiates the same area of the document-reading plane, one light guide is provided with a light-emitting source at one end of the longitudinal direction, while the other light guide is provided with a light-emitting source at the other end of the longitudinal direction.

9. A line illuminating device having a light guide for guiding light from a light source incident from an end surface in the longitudinal direction and for scattering the light at light-scattering patterns formed along the longitudinal direction to emit this light from an emission plane, this line illuminating device being provided with two line illuminating units for housing the light guide in a casing, characterized in that each line illuminating unit is arranged in such a manner that the light emitted from the emission plane of each light guide irradiates the same area of the document-reading plane, and the light guide casing has at least an outside section treated to control scattering and reflection of the light.

10. A line illuminating device having a light guide for conducting light from a light source incident from an end surface in the longitudinal direction and for scattering the light at light-scattering patterns formed along the longitudinal direction to emit this light from an emission plane, this line illuminating device being provided with two line illuminating units for housing the light guide in a casing, characterized in that each line illuminating unit is arranged in such a manner that the light emitted from the emission plane of each light guide irradiates the same area of a document-reading plane, and the light guide casing has at least an outside section covered by a member for controlling scattering and reflection of the light.